

# PATENT SPECIFICATION

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## DRAWINGS ATTACHED

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### (54) A DEVICE FOR WASHING AND DRYING LINEN AND ARTICLES OF WEARING APPAREL

(71) We, INDUSTRIE A. ZANUSSI S.p.A., an Italian Body Corporate, of Via Monteraale, 8-Pordenone, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device for washing and drying linen, such as underwear, and other articles of apparel and, more particularly, it relates to a device for household use intended to carry out washing and drying operations on such articles.

A number of devices are known, both for household and industrial use, which carry out said washing in tubs filled with a detergent liquor. In devices of this kind, the articles to be washed are loaded in a heap and are subjected to a mechanical mixing action by the agency of stirrers, placed in the washing tub, or by intermittent rotation in alternate directions as imparted to a drum which contains the articles in question and is housed within the tub. On completion of washing and rinsing, the removal, which is always partial, of the liquor by which the articles were impregnated, is effected by centrifugal forces and, possibly, by subsequent flow of a heated fluid. These washing methods cause the formation of undesirable creases and wrinkles which are originated mainly during progress of the washing and rinsing stages and are increased during the centrifuging stage. Creasing is reduced, but still remains significant, with the gentle-washing cycles provided for certain fabrics, such as wool, which are treated with a larger amount of water and are not subjected to centrifuging.

At any rate, a drying stage is necessary, which generally takes place outside the washing device. Such a drying, even if carried out by properly hanging the articles, does not give, as a result, the elimination of creases and wrinkles produced by washing. Thus, to obtain an article having an acceptable appearance for

wearing, a subsequent pressing operation is required, whereby creases and wrinkles are completely done away with and a particular aesthetic appearance is imparted to the articles.

Several devices are also known, which, however, are used only on an industrial field, which effect washing by spraying, rather than by immersion, that is by spraying onto the articles the detergent liquor and then the rinsing liquor.

These devices are capable of treating the articles individually as an alternative, in order to treat a number of articles at a time, the devices consist either of conveyors or carousel-like mechanisms having a considerable bulk. Each article is positioned on a specially provided carrier, which is possibly shaped and movable, to allow the washing jets to impinge over the whole inner and outer surfaces of an article. Drying is preferably carried out by circulation of a hot air flow. These washing and drying methods prevent the formation of creases and wrinkles during washing and facilitate the subsequent iron-pressing operation, and sometimes render the same quite unnecessary. However, this device has not proven to possess an adequate efficiency, inasmuch as the spraying action alone is not always sufficient to remove the dirt from the fabric completely; moreover, they cannot be employed, on account of economy and bulk considerations, for household uses.

According to the present invention there is provided a device for washing and drying linen and articles of wearing apparel, such a device comprising a cabinet, a plurality of carriers positioned in the cabinet, the carriers being arranged to allow articles to be treated to be hung thereon, sprinklers for spraying washing and rinsing liquor onto articles to be treated, and means for oscillating the carriers in a direction perpendicular to the surfaces of articles hanging vertically from the carriers to shake articles being treated without tangling the articles or disarranging them from their desired configurations to thereby facilitate

dislodgement of dirt particles from the articles.

In a preferred embodiment, a top sprinkler set is provided, which is intended to distribute the fluid evenly onto the articles to be washed, the shaking movements for the articles being imparted by the supporting rods themselves, to which a horizontal oscillatory motion, such as a harmonic motion is communicated.

In known arrangements articles are hung in close space intervals, and are subjected to vertical oscillations to introduce an appropriate mechanical action in the washing operations.

Such movements, which are vertical, are not very efficient in that the linen can receive comparatively low accelerations which are insufficient to carry out the dislodging of particles or water droplets from the fabric surface. On the other hand, faster accelerations which are thus capable of loosening the fibres and of forcing the penetration and the ejection of the liquid from the fabric, would subject the articles to vertical stresses of such an intensity as to induce undesirable strains and, in addition, lightweight fabrics which have become waterlogged due to the absorption of liquid could be torn in the areas close to the hanging spots.

Moreover, the stresses cannot be applied downwardly since, for accelerations which exceed that of the gravity pull, the fabric does not follow the movement imparted thereto.

Contrarywise, the horizontal acceleration can apply accelerations which, being horizontal in this case, are much less detrimental for the fabric inasmuch as they are perpendicular to the fabric surface and thus can reach higher magnitudes. Above all, the oscillation that the suspension rod imparts to the top portion of the article which has been hung, are sinusoidally transferred along the entire vertical length of the article so that the fabric undergoes alternate and periodical bending motions in both directions, and these are extremely advantageous to the end of washing.

As a matter of fact, these bending motions, in addition to originating movements in the fibres, ensure imperceptible sliding motions between the contacting surfaces of an article which has been folded in two or more plies, thus ensuring the unsticking of dirt in the inner surfaces, the latter being unaffected by the contribution due to the direct impact of washing jets.

The oscillatory motion of the suspension rods can be obtained in any of the manners to be discussed later.

The motion can be obtained with an electric or hydraulic motor and by means of crank gears.

As an alternative, the set of suspension rods can be freely oscillated and the oscillations are impressed by the reaction to hydraulic jet controlled by a switching valve: the oscillations can also be imparted by the rotation of

an eccentrically mounted body having an appropriate mass. Special precautions can be adopted in order to dampen the vibrations possibly transferred by the oscillations of the articles to the cabinet.

Dampening members can be introduced in the linkages.

As an alternative, the suspension rods can be divided into two groups which are oscillated with horizontal motions in contrary directions.

Illustrative embodiments of the invention will now be described with reference to the accompanying drawings, in which:—

Fig. 1 is a diagrammatic perspective view of one form of device;

Figs. 2 and 3 are diagrammatic cross-sectional views, at right angles to one another, of the embodiment shown in Fig. 1;

Fig. 4 is a detail of the oscillation system used in Figs. 2 and 3;

Fig. 5 is a detail view of a modification of the oscillation system;

Figs. 6 and 7 are views, in elevation and plan view, respectively, of a further embodiment of the oscillation system, and

Figs. 8, 9 and 10 are views, similar to Figs. 2, 3 and 4, respectively, of another embodiment of the present invention.

Referring now to the drawings there is shown a cabinet-like casing 10 (Fig. 1) having a door 11, and in which articles 12 to be treated are positioned, by hanging them freely from carriers 13.

The loading of the articles to be treated should be carried out with certain precautions.

The articles 12 should be arranged on the carriers 13 in a distended condition so as not to form creases, or other undesirable folds. Shaped articles, such as shirts, should be positioned on carriers having a shape matching the shape of the articles in question. Articles of a larger size, such as sheets, can be appropriately folded. In this way the space available in the cabinet is used to its best advantage and further on completion of cleaning the articles are folded for immediate storing.

In any event, the articles should never form pockets or baglike formation directed upwards, which would be capable of retaining the dirt dislodged from the overlying portions of the articles. All the surfaces of the articles which are placed vertical should be open towards the bottom so as to provide a free discharge of the dirt while preventing the fabric from carrying out a filtering action towards the flowing liquors.

The distance between two adjoining carriers 13 should be such as to leave an appropriate free gap between the hung articles to allow the flow of the cleaning and rinsing liquor and that of the drying fluid as well.

The articles 12, lasting, may be fastened to their attendant carriers with any conventional means so as to prevent them from

falling onto the bottom wall of the container 10.

The carriers 13 are preferably integral with a frame 14 suspended by rods to permit the horizontal oscillation in a manner to be explained later.

The washing of the articles is obtained by a set of sprinklers 16, housed in the ceiling of the container 10, above the carriers 13.

The upper sprinkler set 16 ensures that the detergent and rinsing liquors are evenly distributed over the articles 12 to be treated. Thus, the latter are thoroughly soaked and are subjected to an "unfolding" or "smoothing" action due to the action of the downwardly directed liquors. The jets of the springler set 16 are preferably of the open, or fan-like type to ensure that the complete article is treated by the water jets. In addition, it is advisable to alternate the oscillation phase of the carriers with the sprinkling stage, to have the sprinkling with the stationary carriers, and the oscillation with a discontinued sprinkling.

The intermittent action of the sprinklers may be achieved by cutting off the flow of liquid thereto or alternatively by stopping the feed pump. Both of these methods allow a pressure build up during the period when the sprinklers are not operating. This pressure build up enhances the efficiency of the sprinklers when they are again operated.

Further, the intermediate action of the sprinklers is advantageous in that it kills the foam of the detergent solution.

The sprinkling set 16 is fed, through a tube 17, by a circulation pump 18 which draws the liquor from the bottom of the container 10, the latter being equipped with a filter 19 (mesh filter) adapted to retain the large particles and impurities. A further filter is provided, on the intake side of the pump 18, for filtering out the finer particles. A discharge pump 20 is provided, in addition, for discharging the liquor through an outlet pipe 21. A conventional heating resistor 22 for the washing liquor is provided on the bottom wall of the container 10. A grid 191 prevents articles of apparel, accidentally fallen from their carriers, contacting the heating element, or clogging the intake port of the pump. For the drying stage, a jacket 23 is provided, to allow the passage and recycling of hot air, with a condensing system for the water vapour evolved during drying, the system comprising a heating resistor 24, a blower 25 actuated by a motor 26, and a set 261 of cold water jets for demisting the air.

For the horizontal oscillation of the supporting rods 13, that is to say of the frame 14, a crank pin 28 and connecting rod 27 are provided, which are driven by a motor 29, the connecting rod 27 being linked to an articulated lever 30, whose lower end is pivoted to the frame 14. In order to dampen the

jerks which would be otherwise transferred to the cabinet-like container 10 due to the oscillations of the frame, a rubber pad system 31 (Fig. 4) is provided, which dampens the jerks and acts as a hinge for the lever 30. This horizontal oscillation system for the frame 14 lends itself particularly to the case in which the oscillation frequency of the frame is low.

In the modification shown in Fig. 5, the oscillation of the frame 14 is still produced by a connecting rod 27 and crank pin 28, but the transfer of the drive to the frame 14 is directly effected by the connecting rod 27 which has a device 32 for dampening the vibrations, of the spring and friction damper type, or of the conventionally known hydraulic shock-absorber type.

In the modification shown in Figs. 6 and 7, the frame 14 is divided into two frames 14A and 14B which are oscillated by means of the suspension pitmans 15A and 15B under the urge of the corresponding connecting rods 27A and 27B, which are associated with a crankshaft 33, the latter being driven by the motor 29.

Contrarily directed oscillations are thus obtained for the two frames 14A and 14B. This approach is particularly suitable for quicker oscillation frequencies, in that it is more efficient in the reducing of the oscillations which are transferred to the cabinet.

Considering then the embodiment shown in Figs. 8, 9 and 10, in order to oscillate the frame 14, which is suspended by pivotal rods such as 16 to the machine ceiling, pulses are supplied by two horizontal counteracting hydraulic jets 100, which are energized alternately, these jets being integral with the oscillating unit. The switching of the two jets can be obtained, for instance, with a conventional rotary valve as actuated by a hydraulic rotor 34 whose number of revolutions will determine, along with the number of ports provided in the rotary valve, the frequency of oscillation of the suspended unit. It is apparent that the switching rotor of the rotary valve can be the rotary sprinkler 16 itself, when it is rotated at an appropriate number of revolutions per minute and is incorporated in the oscillatory unit as shown in Figs. 8, 9 and 10. The support for the rotary sprinkler 16 can be affixed to the cabinet without changing the nature and the operation of the system. In any case, the feeding to the jets 100, the hydraulic rotor 34 and the sprinkling rotor 16 (if affixed to the oscillatory unit) should be achieved by means of a flexible duct 35 adapted to dampen the oscillations which could be transferred to the cabinet.

Obviously, for obtaining the shaking of the hung linen by means of the jets 100, several solutions can be used, other than that of the rotary valve as suggested above. For example, it is possible to embody the jets 100 as a portion of the hydraulic rotor which is either

statically or dynamically unbalanced with respect to its axis of rotation, so that, during rotation, pulses are generated, which are converted into oscillations of the frame 14.

- 5 The above described device, in several embodiments, is capable, of course, of a wide application in the field of industrial laundry and in machines used for large communities.

#### WHAT WE CLAIM IS:—

- 10 1. A device for washing and drying linen and articles of wearing apparel, such a device comprising a cabinet, a plurality of carriers positioned in the cabinet, the carriers being arranged to allow articles to be treated to be  
15 hung thereon, sprinklers for spraying washing and rinsing liquor onto articles to be treated, and means for oscillating the carriers in a direction perpendicular to the surfaces of articles hanging vertically from the carriers  
20 to shake articles being treated without tangling the articles or disarranging them from their desired configurations to thereby facilitate dislodgement of dirt particles from the articles.
2. A device as claimed in claim 1 in which  
25 the sprinklers include a hydraulic rotor and the carriers are mounted on a frame suspended by means of suspension rods for the cabinet top, the frame being adapted to be periodically oscillated by means of a crank and connecting  
30 rod mechanism.
3. A device as claimed in claim 2, in which the connecting rod is connected to the frame, and there being provided damping means for limiting the oscillations transmitted to the  
35 cabinet.
4. A device as claimed in claim 2, in which the connecting rod is directly pivoted to the frame and is provided with a frictional or hydraulic type damper for damping vibrations.

5. A device as claimed in claim 2, in which the frame is divided into two independent portions which are adapted to be oscillated by two respective connecting rods controlled by a single crankshaft to obtain contrarywise-acting oscillations.

6. A device as claimed in any one of the preceding claims in which the carriers are mounted on a frame which is freely suspended from the cabinet by means of rods, the frame carrying, integrally therewith, a set of two counter-acting sprinklers adapted to be fed through flexible tubing and alternately in sequence by the agency of a rotary valve to thereby receive pulses adapted to oscillate the frame.

7. A device as claimed in claim 6, in which the rotary valve is adapted to be actuated by a hydraulic rotor.

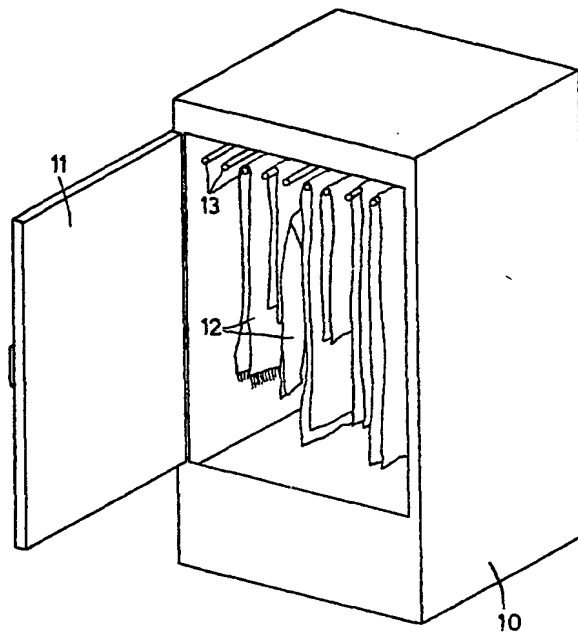
8. A device as claimed in any one of claims 1 to 5, in which the sprinklers are an integral part of a hydraulic rotor which is statically and/or dynamically unbalanced with respect to its axis of rotation.

9. A washing and drying device constructed and arranged substantially as described herein with reference to and as shown by Figures 1 to 4 or Figures 8 to 10 of the accompanying drawings.

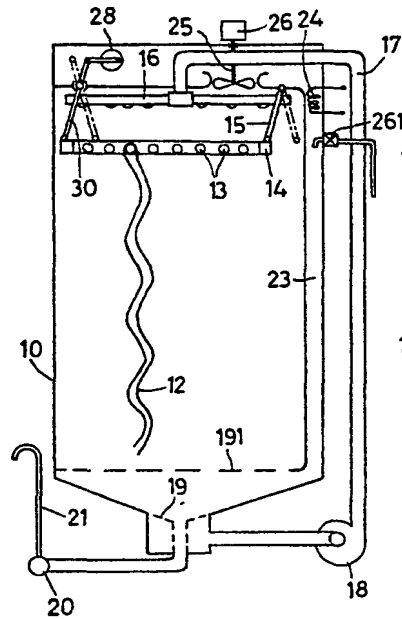
10. A device as claimed in claim 1 including an oscillating system constructed and arranged substantially as described herein with reference to and as shown by Figure 5 or Figures 6 and 7 of the accompanying drawings.

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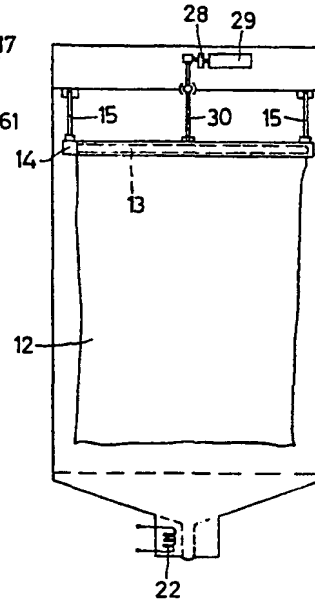
Fig.1



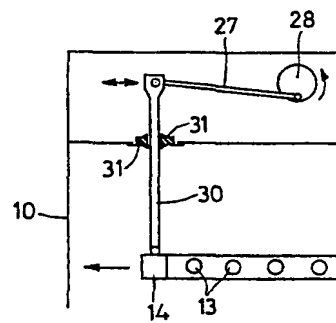
**Fig.2**



**Fig.3**



**Fig.4**



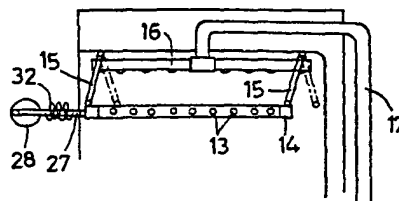


Fig.5

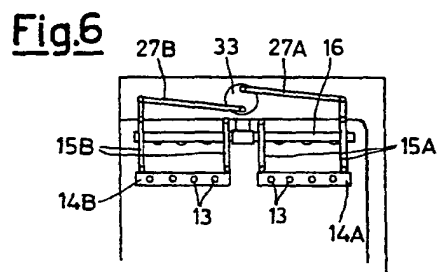


Fig.6

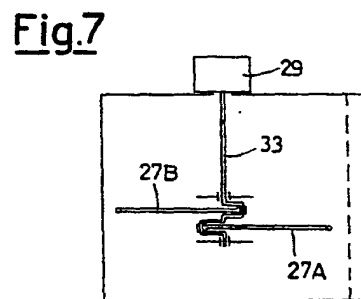
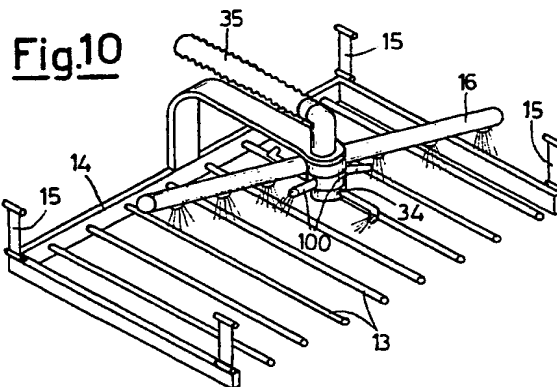
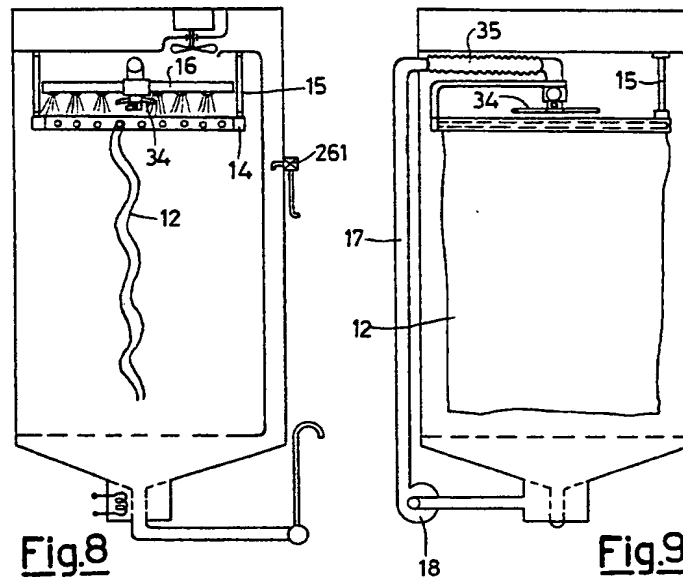


Fig.7



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